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## ALASKA FOREST RESEARCH CENTER

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### Use of Long-Log Scaling Tables in Southeast Alaska

In Southeast Alaska, logs are generally yarded into tidewater where they are scaled after being rafted. Approximately two-thirds of the individual pieces are longer than 42 feet. Since the maximum scaling length is 40 feet these long-logs must be scaled as two or more logs which presents several problems. Measurement of diameters of uncut sections with the conventional scale stick is subject to error. Measurement of diameters with scaling calipers at several points along the piece is time-consuming.

Long-log board-foot tables based on the Scribner Dec. C. rule were made to facilitate scaling of this material. These were based on a study<sup>1/</sup> which indicated that the average taper of western hemlock and Sitka spruce logs in Southeast Alaska was one inch per 6 feet of log length. Similar tables for long-logs are extensively used by commercial scaling bureaus in the Pacific Northwest. These permit obtaining gross volume of long-logs by measuring top "d.i.b." and total length. The use of the long-log tables reduces the scaling job in the Alaska region by approximately 50 percent. This paper presents the results of a study designed to check the accuracy of the log scale obtained by use of long-log tables.

Methods of Study. The first phase of the study consisted of making precise measurements of a sample of logs drawn from a number of rafts which came from many locations within the Ketchikan sale area. Total length of each piece was measured to the nearest tenth-foot with a steel tape. If the piece was longer than 42 feet, it was subdivided into two or more logs as nearly equal as possible in even feet, plus trim allowance in accordance with standard scaling practice. Two diameter measurements were taken at right angles to each other, to the nearest tenth-inch at the top, mid-point, and butt-end of each log, with an additional measurement at d.a.s. (diameter above swell) if the butt section had pronounced flare. The volume of each piece was then obtained from Scribner Dec. C. log rule tables after rounding off the top diameter of each log to the nearest inch.

The second phase of the study consisted of a comparison (table 1) of caliper scaling and long-log tables on 17 rafts totaling over 6 million board feet from an area north of the Ketchikan unit.

Discussion. Analysis of data obtained from the first phase of the study showed that the variation of taper by individual logs was quite high, but the variation about the mean of a large number of logs was low. The average taper of the sample was found to be one inch in 6.9 feet of length with a standard deviation of  $\pm 3.05$  feet and a standard error of estimate of  $\pm 0.16$  feet. The long-log tables gave a 2.09 percent higher scale than that obtained by individual logs. The average deviation was 9.95 percent. The standard error of the ratio<sup>2/</sup> between scale by individual logs and the use of long-log tables was 0.55 percent. The ratio between

<sup>1/</sup> Andersen, H. E. Unpublished manuscript in U. S. Forest Service files, 1948.

<sup>2/</sup> Formula, suggested by R. A. Chapman, Statistician, U. S. Forest Service, available in progress report.

the board-foot scale obtained by measuring individual logs and that obtained from long-log tables is  $0.0706 \pm .0055$  for the sample.

If no difference in scale existed, the ratio would be 1.0000 which is 3.7 standard errors greater than the ratio of the sample. There are only about 2 chances in 10,000 that this is due to sampling and it may, therefore, be concluded that the difference is statistically significant. It can be accounted for by the fact that the sample had a taper slightly less (1 inch to 6.9 feet) than the 1 inch to 6 feet on which the long-log tables were based. From a practical point of view, however, the difference of 2.09 percent in scale may be of minor importance. In check scaling, a difference of one to two percent of the gross scale is usually considered acceptable.

Table 1 indicates that on a number of rafts from the central to northern part of Southeast Alaska, the difference in aggregate scale of 0.13 percent by the two methods is negligible. The average scale difference by rafts is 2.25 percent, and in 11 out of 17 rafts the difference in scale by the two methods was less than two percent. An analysis of that data by location of rafts indicates that the rate of taper increases from the southern to northern portion of the region.

On the basis of this study it appears that the taper of 1 inch per 6 feet in length is representative for spruce and hemlock logs from Southeast Alaska. Therefore, use of long-log tables based on this taper should result in log scales of acceptable accuracy at savings in scaling time and costs. The long-log table should not, however, be used for western redcedar as available data indicates this species has a greater taper.

Table 1.—Individual log scale compared to long-log table scale of 17 rafts.

Raft	No. of pieces	Scale by individual logs Ft. BM	Scale from long-log tables Ft. BM	Percentage difference
1	468	521,660	486,750	- 6.69
2	90	108,350	109,750	+ 1.29
3	53	112,110	112,130	+ 0.02
4	332	190,190	192,320	+ 1.12
5	75	170,930	172,990	+ 1.21
6	214	332,440	326,640	- 1.74
7	183	156,200	163,310	+ 4.55
8	418	440,840	445,790	+ 1.12
9	276	238,430	235,800	- 1.10
10	362	452,680	466,660	+ 3.09
11	176	372,840	383,060	+ 2.74
12	194	220,670	206,440	- 6.45
13	331	435,450	435,410	- .01
14	687	1,241,440	1,225,570	- 1.28
15	684	422,530	439,200	+ 3.95
16	184	327,380	332,050	+ 1.43
17	312	542,110	544,230	+ 0.39
Total	5,039	6,286,250	6,278,100	38.18
Aggregate difference - 0.13 percent		Average difference 2.25 percent		

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